Cramer et al. ("Cramer"). Applicant respectfully traverses this rejection.

Applicant notes that, contrary to the Office Action's assertion, nothing in the claims indicates or implies the cause of a subsurface defect; thus, the statement that "the crack was caused by heating a sample" (p. 2) is irrelevant to the present application, nor do the claims imply that the heating process causes the defect.

The Office Action admitted that Devitt does not disclose a thermal imager, but asserted, "it would have been obvious. . . to replace the thermal imager in the device disclosed by Devitt with the thermal video imager, as taught by Cramer, so as to generate a video information of the thermal characteristics of the specimen" (p. 3). Applicant respectfully disagrees.

Devitt fails to teach the claimed invention because Devitt does not show a non-destructive evaluation method. The Office Action asserted that Devitt discloses "a device of method of applying a stress to a sample/specimen already having a crack or subsurface defect so that the crack becomes detectable" (p. 2). However, Devitt specifically teaches applying enough force to cause the subsurface defect to open at the surface (col. 7, lines 28-42). In other words, Devitt teaches enlarging a subsurface defect and transforming the subsurface defect into a surface defect to allow detection of the defect at the component surface. Devitt therefore teaches a destructive evaluation method.

Although Devitt does mention keeping the applied stress at an intensity level below a "characteristic damage threshold stress intensity factor" (see, e.g., claim 25), those of skill in the art understand that the stress needed to initiate damage (i.e., the damage threshold) is considerably greater than the stress needed

to aggravate existing damage, such as a subsurface defect. The Devitt method can apply a stress below the threshold stress intensity and still damage the sample by expanding the subsurface defect into a surface defect.

In fact, the Devitt method cannot detect pure subsurface defects at all because Devitt requires exposing the defect to optical radiation and monitoring the emissivity difference between the crack and the surrounding surface area (col. 6, line 52 to col. 7, line 5). If the subsurface defect is not opened and exposed to the sample surface through a destructive process, the defect will not be able to absorb the incident radiation required to create an energy differential between the defect and its surrounding area. Devitt assumes that any defect must be opened at the sample surface, either originally or after applying a destructive stress, to absorb enough radiated energy to render the defect detectable (see, e.g., col. 7, lines 6-14). Thus, Devitt does not suggest a non-destructive evaluation process that detects subsurface defects.

Adding Li and Cramer to Devitt still fails to teach or suggest the claimed invention. Li is irrelevant to the claimed invention because Li focuses on a method for making heat resistant electronic equipment using composite materials as solder (see, e.g., Abstract). Li does not mention defect detection anywhere in its disclosure, focusing instead on the electrical and thermal resistance characteristics of cracks in a composite matrix having too many reinforcing elements (col. 5, line 58 to col. 6, line 22). One of ordinary skill in the art would not have even referred to the Li reference when considering defect detection because, at best, Li suggests avoiding conventional solder for electronic equipment to prevent cracking caused by thermal mismatch stresses. This clearly has nothing to

do with defect detection, much less a non-destructive evaluation process.

Further, there is no motivation to combine Devitt with Cramer because Devitt explicitly teaches away from using non-destructive, conductive heating techniques (col. 6, lines 52-56; col. 6, line 68 to col. 7, line 4) like the method taught in Cramer. Devitt specifically describes the disadvantages of non-destructive evaluation techniques (col. 1, line 28 to col. 2, line 54), implying that its own method is a destructive evaluation technique that creates new defects (i.e., surface defects) from existing defects (i.e., subsurface defects) for easier detection. Also, Cramer specifically describes the disadvantages of Devitt at col. 3, lines 27-64, further teaching away from the Devitt/Cramer combination proposed by the Office Action.

One of ordinary skill in the art would not have combined Devitt with Cramer because Devitt teaches away from non-destructive evaluation techniques using conductive heating, as taught in Cramer, and because Cramer specifically teaches away from the Devitt method. Further, even if Devitt and Cramer could be properly combined, it still would not suggest the claimed invention because the combination fails to teach a non-destructive evaluation method and system that exacerbates a thermal discontinuity. As explained above, Devitt exacerbates a defect in a destructive manner. Cramer is a non-destruction evaluation system, but does not teach exacerbating the defect at all. At best, the combination suggested by the Office Action teaches a destructive evaluation method that opens a subsurface defect to the sample surface for thermal imaging. This is clearly contrary to the claimed non-destructive evaluation method and system.

Because there is no motivation to combine Devitt, Li, and Cramer, the Office Action fails to establish a prima facie case of obviousness with respect to claims 1, 3 and 18. Withdrawal of the rejection is respectfully requested.

Claims 2, 4-6, 15-16 and 23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Devitt, Li and Cramer and further in view of U.S. Patent No. 5,587,532 to Rose ("Rose") and U.S. Patent No. 4,752,140 to Cielo ("Cielo"). Applicant respectfully traverses this rejection. As explained above, there is no motivation to combine Devitt with Li or Cramer because Li has nothing to do with defect detection and because the Devitt and Cramer references teach away from each other. There is no motivation to combine either Rose or Cielo with Devitt because both Rose and Cielo focus on subsurface defect detection methods that do not require the defect to be opened to the sample's surface.

Both Rose and Cielo assume that the defect lies completely below the surface (Rose, col. 4, lines 30-43; Cielo, Figs. 1 and 2) and do not remotely suggest opening a defect to the sample surface as required by Devitt. One of ordinary skill in the art would not have viewed Rose and Cielo as appropriate ways to exacerbate defects in the Devitt system because Devitt requires opening subsurface defects to expose the defects to the sample's surface while Rose and Cielo clearly avoid doing so.

With respect to Rose, one of ordinary skill in the art would not have viewed Rose as even being relevant to defect detection. Rose teaches a method of testing the wear resistance of ceramic materials by measuring subsurface crack propagation (col. 1, lines 1-58) after applying a Vickers indentation on the material's surface (col. 4, lines 29-43). Rather than using gas pressure to deform a sample, Rose focuses solely on monitoring

acoustic signals generated by changes in gas pressure (col. 5, lines 14-23). Nothing in Rose remotely suggests using pressure to exacerbate a thermal discontinuity, particularly when Rose does not even mention thermal discontinuities at all.

Cielo mentions deforming a layer using vacuum, vibration, or surface heating in combination with holographic exposures (col. 1, lines 51-59), but Cielo unilaterally dismisses these deformation methods and in fact teaches away from combining these methods with a sample heating process (col. 2, lines 5-19). Cielo also teaches away from the laser scanning method taught in Devitt, stating that such methods take too long to cover an entire part surface (col. 2, line 43 to col. 3, line 9). Thus, one of ordinary skill in the art would not have been led to combine Devitt with Cielo in the manner suggested by the Office Action.

Cielo only teaches using a focused thermal radiation pulse to vertically displace the top layer of areas where delamination has occurred through thermal deformation. The vertical displacement is measured with an optical interferometer (col. 3, lines 29-37). Cielo requires the thermal radiation to be applied to an area smaller than the smallest delaminated area to be detected (col. 3, line 63 to col. 4, line 45), but does not remotely suggest generating a thermal image based on the sample's thermal characteristics; the heating step is only for vertical displacement.

In fact, Cielo teaches away from any detection method that monitors thermal characteristics, stating that inspection according to propagation of thermal energy takes an unacceptably long time to complete (col. 2, line 42 to col. 3, line 9). Cielo also specifically discourages heating the sample 10 to 20 degrees Celsius above ambient temperature (col. 2, lines 5-12), while

Cramer specifies at least 10 degrees Celsius above ambient for its method (col. 5, lines 20-25), further showing lack of motivation to combine the references in the manner proposed by the Office Action. Thus, one of ordinary skill in the art would not have been led to even consider Cielo with respect to the claimed invention.

Because both Rose and Cielo fail to teach defect detection through thermal discontinuities, and because there is no motivation to add Rose and Cielo to Devitt, Li and Cramer, the Office Action fails to establish a prima facie case of obviousness with respect to claims 2, 4-6, 15-16 and 23, and withdrawal of the rejection is respectfully requested.

Claims 19-22 and 24-26 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Devitt, Li, Cramer, Rose, Cielo and further in view of an article entitled "Thermography and Ultrasonic Finds Flaws in Composites" ("the Article"). Applicant respectfully traverses this rejection.

Claims 19-22 and 24-26 depend on patentable claim 18 and are therefore also patentable for the reasons above. Adding the Article to the proposed combination would not have rendered the claimed invention obvious because the Article focuses only on using flash lamps in non-destructive inspections, without addressing the deficiencies noted above in the proposed Devitt/Li/Cramer combination. As explained above, Devitt suggests a destructive evaluation process and teaches away from methods that do not open subsurface defects to the sample's surface or methods that rely on conductive heating.

The Article only describes, in the most general manner, using sequentially applied thermographic and ultrasonic techniques for non-destructive inspection. Although the Article mentions using a flashlamp to heat

the surface of the structure being tested, this runs directly contrary to the teachings in Cielo, which requires heating to be conducted in an area smaller than the smallest detectable defect; in fact, the Article admits that thermography does not readily detect small flaws (p. 44), further indicating that the Article is not properly combinable with Cielo and the other cited references.

One of ordinary skill in the art would not have combined the references as suggested in the Office Action because of their widely disparate and contradictory teachings, as noted above, particularly when several of the references specifically teach away from each other. Withdrawal of the rejection is therefore respectfully requested.

Claims 27-28 were rejected under 35 U.S.C. § 103(1) as being unpatentable over Devitt, Li, and Cramer and further in view of U.S. Patent No. 5,709,469 to White et al. ("White"). Applicant respectfully traverses this rejection.

Claims 27-28 depend on claim 18 and are therefore patentable for the reasons explained above. Even though White discloses a heat lamp generally, White assumes that its heat lamp is used in a non-destructive process (see, e.g., col. 5, lines 26-48). Applicant respectfully notes that the Office Action misconstrues the invention by stating that "both of these device are alternative types of heaters which will perform the same function of heating the specimen in order to cause a thermal defect". Applicant reiterates that none of the claims state or imply the cause of the defect to be detected, nor is the cause relevant.

Further, nothing in White overcomes the fact that Devitt teaches away from non-destructive evaluation techniques of the type shown in Cramer and White. Also,

nothing in White remotely suggests exacerbating a thermal discontinuity in the sample, making it impossible to detect a kissing unbond defect using White's method. White only focuses on heating a test patch and comparing its thermographic image with a calibration image (see, e.g., Abstract).

Moreover, the Office Action's argument that air can act as a coupling media/agent to apply a force to the specimen is erroneous. None of the cited references remotely suggest such an interpretation, nor do any of the references teach using ultrasound waves to exacerbate a thermal discontinuity in the claimed manner. Further, the Office Action fails to set forth any evidence that exacerbation is possible using ultrasound waves and air as the coupling medium. MPEP § 2144.03 requires that any rejection based on "well-known" prior art must be "capable of instant and unquestionable demonstration as being 'well-known'". The Office Action fails to meet this burden because applying a force via ultrasound waves onto a sample to exacerbate a thermal discontinuity is far from a statement of common knowledge. Withdrawal of the rejection is respectfully requested.

Applicant thanks the Examiner for indicating that claims 7-14 and 17 would be allowable if rewritten in independent form. Applicant notes, however, that the Office Action fails to establish a prima facie case with respect to all of the pending claims and are therefore patentable for the reasons explained above.

All objections and rejections having been addressed, it is respectfully submitted that the present application is in condition for allowance, and a Notice to that effect is earnestly solicited.

Any fees associated with the filing of this paper should be identified in any accompanying transmittal. However, if any additional fees are required, they may be

charged to Deposit Account 18-0013 in the name of Rader, Fishman & Grauer PLLC.

Respectfully submitted,

Dated: December 13, 2001

By
Joseph W. Coppola
Reg. No. 33,373
RADER, FISHMAN & GRAUER PLLC
39533 Woodward Avenue
Suite 140
Bloomfield Hills, MI 48304
(248) 594-0650

CERTIFICATE OF MAILING

I hereby certify that the enclosed Amendment is being deposited with the United States Postal Service as first class mail, postage prepaid, in an envelope addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231 on this 14th day of December, 2001.

R0128907.DOC